

We claim:

1. A method for direct start of an internal combustion engine with direct fuel injection into at least one combustion chamber of the engine that is filled with air, wherein said method comprises at least one step for improving or increasing fuel vaporization in said at least one combustion chamber when a start temperature (T) of the internal combustion engine is below a predetermined start temperature threshold (T_S).

2. The method as defined in claim 1, wherein said at least one step includes increasing a combustion temperature in said at least one combustion chamber prior to said direct start.

3. The method as defined in claim 2, wherein said combustion temperature is increased by at least one of the following:

supplying pre-heated air to said at least one combustion chamber of the engine;

activating a heating device arranged in at least one cylinder head of the engine;

activating another heating device arranged in cylinder walls of the engine;

circulating a cooling medium with a circulating pump in a cooling water circulation of the engine and heating of the cooling water circulation; and

heating of at least one piston base of at least one piston reciprocating in the engine.

4. The method as defined in claim 1, wherein said at least one step includes heating fuel to be injected in the at least one combustion chamber (14) of the engine (12).

5. The method as defined in claim 4, wherein fuel injection valves (22) and other fuel conducting parts (44) of the engine (12) are heated.

6. The method as defined in claim 1, further comprising heating a lubricant circulating through the internal combustion engine (12).

7. The method as defined in claim 1, wherein said at least one step is initiated or activated prior to the direct start of the internal combustion engine.

8. The method as defined in claim 1, wherein said at least one step is performed prior to a procedure (28) required for starting the internal combustion engine (12).

9. The method as defined in claim 8, wherein said at least one step is performed when a remote control signal (28) is generated for opening a door of a motor vehicle that includes the internal combustion engine (12).

10. The method as defined in claim 1, wherein alternatively or in addition to said at least one step a starting fuel is injected in a first injection event occurring for the direct start and said starting fuel has a greater vapor pressure than that of a standard fuel used for further operation of the internal combustion engine (12).

11. The method as defined in claim 10, wherein said starting fuel is hydrogen, said hydrogen is produced by electrolysis of water during travel of a motor vehicle including the internal combustion engine, said hydrogen is stored in a pressurized hydrogen tank until subsequent start of the engine and during starting of the internal combustion engine said hydrogen is burned with air oxygen or alternatively or in addition with oxygen generated during the electrolysis to form hydrogen.

12. The method as defined in claim 1, in which in an internal combustion engine with multiple cylinders at least one combustion event (106) is initiated in a cylinder (96) in a compression cycle so that a crankshaft (86) of the internal combustion engine (12) is rotated first in a rotation direction opposite to a normal rotation direction (112) of the crankshaft so that another cylinder (98) in a working cycle experiences a compression event, and then a combustion event (114) is initiated in said another cylinder (98), which accelerates said crankshaft (86) in said normal rotation direction (112).

13. A control unit (20) for control of direct start of an internal combustion engine, said internal combustion engine having direct fuel injection into at least one air-filled combustion chamber of said engine, wherein said control unit (20) is structured to control at least one step of a method for direct start of said internal combustion engine according to claim 1.

14. A control unit (20) for control of direct start of an internal combustion engine, said internal combustion engine having direct fuel injection into at least one air-filled combustion chamber of said engine, wherein said control unit (20) comprises means for controlling at least one device for increasing fuel vaporization of fuel in said at least one combustion chamber when a start temperature (T) of the internal combustion engine is below a predetermined start temperature threshold (T_S).

15. A control unit (20) for control of direct start of an internal combustion engine, said internal combustion engine having direct fuel injection into at least one air-filled combustion chamber of said engine, wherein said control unit (20) comprises means for controlling at least one of

a device for heating air supplied to said at least one combustion chamber of the engine;

a device for heating fuel supplied to said at least one combustion chamber of the engine;

a heating device arranged in at least one cylinder head of the engine;

another heating device arranged in cylinder walls of the engine;

a cooling water heating device for a cooling water circulation through the engine; and

an additional heating device for heating at least one piston base of at least one piston reciprocating in the engine.